Claims

What we claim is:

1. A composition comprising a biodegradable polymer having a ligand attached thereto, and wherein said ligand is attached to said biodegradable polymer using a biological recognition event.

2. A composition comprising a biomaterial architecture having a ligand attached thereto through a biological recognition event, and wherein said biological recognition event is further characterized in that it involves an anchor-adapter-tag unit, whereby said anchor is attached to the biomaterial architecture and said tag is attached to the ligand, and said adapter is capable of binding to both the anchor and the tag to effect the biological recognition event.

3. The composition of claim 2, wherein said anchor-adapter-tag unit is a three-component system.

4. The composition of claim 2, wherein said anchor-adapter-tag unit is a two-component system, whereby the anchor and adapter functionalities are provided by one molecule capable of effecting interaction with the tag unit, and an anchor-tag system is generated.

5. The composition of claim 2, wherein said anchor-adapter-tag unit is a two-component system, whereby the adapter and tag functionalities are provided by one molecule capable of effecting interaction with the adapter unit, and an anchor-tag system is generated.

6. The composition of claim 2, wherein the anchor and tag independently comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and

the desired ligand, and wherein the adapter comprises any biologically relevant molecule capable of binding to both the anchor and tag moieties to generate a biomolecular interaction.

7. The composition of claim 2, wherein said biomaterial architecture comprises a biodegradable polymer.

8. The composition of claim 2, wherein said anchor is incorporated into the polymer during polymer synthesis.

9. The composition of claim 2, wherein said polymer is PLA-PEG.

10. The composition of claim 2, wherein said biodegradable polymer is selected from the group consisting of polymers of poly(hydroxy acids), polyanhydrides, polyorthoesters, polyphosphazenes, polyphosphates, polycaprolactone, polyhydroxybutyrates, polyesters, polyamides, polysaccharides, polyproteins, copolymers or blends thereof.

11. The composition of claim 2, wherein the anchor and tag comprise biotin and the adapter comprises avidin or streptavidin.

12. The composition of claim 2, wherein the anchor and tag comprise the same or different hapten, and the adapter comprises an antibody having the required specificity for the hapten(s).

13. The composition of claim 2, wherein said ligand comprises a biologically relevant compound selected from the group consisting of peptide, protein, carbohydrate, nucleic acid, lipid, polysaccharide, and combinations thereof.

14. The composition of claim 4, wherein the tag comprises a hapten and the anchor comprises an antibody having the required specificity for the hapten.

15. The composition of claim 4, wherein the anchor comprises avidin and the tag comprises biotin.

16. The composition of claim 5, wherein the anchor comprises a hapten and the tag comprises an antibody having the required specificity for the hapten.

17. The composition of claim 5, wherein the anchor comprises biotin and the tag comprises avidin.

18. A method for synthesizing a biomaterial architecture having an anchor associated therewith comprising:

providing a solution of a biodegradable polymeric material, wherein said polymeric material is capable of having an anchor moiety associated therewith and wherein said polymeric material has at least one functionality capable of further polymerization;

contacting said solution with an anchor moiety capable of associating with said polymeric material; and

subjecting said polymeric material having an anchor associated therewith to conditions capable of effecting further polymerization at a desired functionality to yield a desired polymeric material.

19. The method of claim 18, wherein said biodegradable polymeric material comprises α-amine ω-hydroxy poly(ethylene glycol), and wherein this material having an anchor associated therewith is further polymerized at the lactide functionality to generate a PLA (poly (lactic acid))-PEG block copolymer having an anchor associated therewith.

20. The method of claim 18 or 19, wherein said anchor moiety comprises biotin.

21. The method of claim 18 or 19, wherein said anchor moiety comprises avidin.

22. The method of claim 18 or 19, wherein said anchor moiety comprises an antibody or antibody fragment.

23. The method of claim 18 or 19, wherein said anchor moiety comprises a hapten.

24. A method for the modification of a biomaterial architecture comprising:

providing a biomaterial architecture, having an anchor attached thereto or incorporated therein;

contacting said biomaterial-anchor moiety with an adapter moiety; and

contacting said biomaterial-anchor-adapter moiety with a desired ligand having a tag incorporated therein to produce a biomaterial-anchor-adapter-tag-ligand moiety.

25. The method of claim 24, wherein the anchor and tag independently comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and wherein the adapter comprises any biologically relevant molecule capable of binding to both the anchor and tag moieties.

26. The method of claim 24, wherein said biomaterial architecture comprises a biodegradable polymer.

27. The method of claim 24, wherein said anchor is incorporated into the polymer during polymer synthesis.

28. The method of claim 27, wherein said polymer is preferably PLA-PEG.

29. The method of claim 24, wherein said biodegradable polymer is selected from the group consisting of polymers of polyhydroxy acids, polyanhydrides, polyorthoesters,

polyphosphazenes, polyphosphates, polycaprolactone, polyhydroxybutyrates, polyesters, polyamides, polysaccharides, polyproteins, and copolymers and blends thereof.

30. The method of claim 24, wherein the anchor and tag comprise biotin and the adapter comprises avidin or streptavidin.

31. The method of claim 24, wherein the anchor and tag comprise the same or different hapten, and the adapter comprises an antibody having the required specificity for the hapten(s).

32. The method of claim 24, wherein said ligand comprises a biologically relevant compound selected from the group consisting of peptide, protein, carbohydrate, nucleic acid, lipid, polysaccharide, and combinations thereof.

33. A method for the modification of a biomaterial architecture comprising:

providing a biomaterial architecture, having an anchor attached thereto or incorporated therein; and

contacting said biomaterial-anchor moiety with a desired ligand having a tag incorporated therein to produce a biomaterial-anchor-tag-ligand moiety.

34. The method of claim 33, wherein the anchor and tag independently comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and effecting a biomolecular interaction between the anchor and tag.

35. The method of claim 33, wherein said biomaterial architecture comprises a biodegradable polymer.

36. The method of claim 33, wherein said anchor is incorporated into the polymer during polymer synthesis.

37. The method of claim 36, wherein said polymer is preferably PLA-PEG.

38. The method of claim 33, wherein said biodegradable polymer is selected from the group consisting of polymers of polyhydroxy acids, polyanhydrides, polyorthoesters, polyphosphazenes, polyphosphates, polycaprolactone, polyhydroxybutyrates, polyesters, polyamides, polysaccharides, polyproteins, and copolymers and blends thereof.

39. The method of claim 33, wherein the anchor comprises biotin and the tag comprises avidin or streptavidin.

40 The method of claim 33, wherein the anchor comprises avidin or streptavidin and the tag comprises biotin.

41. The method of claim 33, wherein the anchor comprises a hapten, and the tag comprises an antibody having the required specificity for the hapten.

42. The method of claim 33, wherein the tag comprises a hapten, and the anchor comprises an antibody having the required specificity for the hapten.

43. The method of claim 33, wherein said ligand comprises a biologically relevant compound selected from the group consisting of peptide, protein, carbohydrate, nucleic acid, lipid, polysaccharide, and combinations thereof.

44. A method for tissue engineering comprising:

providing a scaffold having a biological ligand attached thereto, wherein said ligand is attached by a biomolecular interaction;

contacting said scaffold with cells, wherein said cells interact specifically with the ligand attached to the scaffold;

promoting cell growth and/or differentiation to generate tissue; and

implanting said tissue.

45. The method of claim 44, wherein said biomolecular interaction is characterized in that it involves an anchor-adapter-tag unit, whereby said anchor is attached to the biomaterial architecture and said tag is attached to the ligand, and said adapter is capable of binding to both the anchor and the tag.

46. The method of claim 44, wherein the anchor and tag independently comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and wherein the adapter comprises any biologically relevant molecule capable of binding to both the anchor and tag moieties to generate a biomolecular interaction.

47. The method of claim 44, wherein said biomolecular interaction is characterized in that it involves an anchor-tag unit, whereby said anchor is attached to the biomaterial architecture and said tag is attached to the ligand and wherein either the anchor or the tag is capable of effecting a biomolecular interaction between the anchor and the tag.

48. The method of claim 47, wherein the anchor and tag comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and wherein a biomolecular interaction is effected between the anchor and the tag.

49. The method of claim 44, wherein said scaffold comprises a biodegradable polymer.

50. The method of claim 45 or 47, wherein said anchor is incorporated into the polymer during polymer synthesis.

51. The method of claim 50, wherein said polymer is PLA-PEG.

52. The method of claim 44 wherein promoting cell growth and/or differentiation comprises seeding cells in a bioreactor.

53. The method of claim 44, wherein implanting said tissue comprises implanting tissue still attached to the scaffold.

54. The method of claim 44, wherein implanting said tissue comprises degrading the scaffold and implanting the tissue without the scaffold.

55. A method for site specific delivery of therapeutic agents comprising:

providing a composition further comprising:

a biomaterial architecture, wherein said architecture has a biological ligand attached thereto by a biomolecular interaction, and

a therapeutic agent associated therewith; and

contacting said composition with cells, wherein the ligand attached to the biomaterial architecture interacts with the cells to effect site specific delivery of the therapeutic agent to the cells.

56. The method of claim 55, wherein said biomolecular interaction is further characterized in that it involves an anchor-adapter-tag unit, whereby said anchor is attached to the biomaterial architecture and wherein said tag is attached to the ligand, and said adapter is capable of binding to both the anchor and the tag.

57. The method of claim 56, wherein the anchor and tag independently comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and wherein the adapter comprises any biologically relevant molecule capable of binding to both the anchor and tag moieties to generate a biomolecular interaction.

58. The method of claim 55, wherein said biomolecular interaction is characterized in that it involves an anchor-tag unit, whereby said anchor is attached to the biomaterial architecture and said tag is attached to the ligand and wherein either the anchor or the tag is capable of effecting a biomolecular interaction between the anchor and the tag.

59. The method of claim 58, wherein the anchor and tag comprise any biologically relevant molecule capable of being incorporated into the biomaterial architecture and the desired ligand, and wherein a biomolecular interaction is effected between the anchor and the tag.

60. The method of claim 55, wherein said biomaterial architecture comprises a biodegradable polymer.

61. The method of claim 56 or 58, wherein said anchor is incorporated into the polymer during polymer synthesis.

62. The method of claim 61, wherein said polymer is PLA-PEG.

63. The method of claim 55, wherein said therapeutic agent is selected from the group consisting of anti-AIDS substances, anti-cancer substances, antibiotics, immunosuppressants, anti-viral substances, enzyme, inhibitors, neurotoxins, opioids, hypnotics, antihistamines, lubricants, tranquilizers, anti-convulsants, muscle relaxants, anti-Parkinson's substances, anti-spasmodics, muscle contractants, miotics, anti-cholinergics, anti-glaucoma compounds, anti-parasite compounds, anti-protozoal compounds, anti-hypertensives, analgesics, anti-pyretics, anti-inflammatory agents, local anesthetics, opthalmics, prostaglandins, anti-depressants, anti-psychotic substances, anti-emetics, imaging agents, specific targeting agents, neurotransmitters, proteins, cell response modifiers, vaccines, ribozymes, anti-sense agents, cytokines, immunotoxins, radiosensitizers, anti-edema agents, RNA, and combinations thereof.

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